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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/795,915	03/08/2004	Yia-Chung Chang	TWI-23710	1815

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STALLMAN & POLLOCK LLP  
353 SACRAMENTO STREET  
SUITE 2200  
SAN FRANCISCO, CA 94111

EXAMINER

GEISEL, KARA E

ART UNIT PAPER NUMBER

2877

DATE MAILED: 06/28/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

10/795,915

Applicant(s)

CHANG ET AL.

Examiner

Kara E. Geisel

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 08 March 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-25 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 8-11 is/are allowed.
- 6) ☒ Claim(s) 1-5, 12 and 15-25 is/are rejected.
- 7) ☒ Claim(s) 6, 7, 13 and 14 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 08 March 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

## Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date <u>0605_0304</u> | 6) <input type="checkbox"/> Other: _____  |

## DETAILED ACTION

### *Information Disclosure Statement*

The information disclosure statements filed March 8<sup>th</sup>, 2004, and June 20<sup>th</sup>, 2005 have been considered by the examiner.

### *Claim Objections*

The numbering of claims is not in accordance with 37 CFR 1.126 which requires the original numbering of the claims to be preserved throughout the prosecution. When claims are canceled, the remaining claims must not be renumbered. When new claims are presented, they must be numbered consecutively beginning with the number next following the highest numbered claims previously presented (whether entered or not).

In the instant case, there are two claims numbered 21 and two claims numbered 22. Therefore, the last three claims have been renumbered 23-25.

### *Claim Rejections - 35 USC § 102*

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-5, 12, and 15-25 are rejected under 35 U.S.C. 102(e) as being anticipated by Shchegrov et al. (US Pubs 2004/0070772).

In regards to claim 1, Shchegrov discloses a method for optically inspecting a sample (fig. 5A), comprising illuminating the sample with a probe beam (page 4, ¶ 48), measuring the diffraction resulting

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from the interaction of the probe beam and the sample (page 4, ¶ 49), defining a model of the sample, the model including a first series of three-dimensional shapes that define the edge of a line within the sample (page 5, ¶s 55, 58-59, and 62), evaluating the model in three dimensions to predict the diffraction resulting from the interaction of the probe beam and the sample (page 6, ¶ 63), and adjusting and reevaluating the model to minimize the difference between the predicted and measured data (page 6, ¶ 67).

In regards to claims 2-5, the three dimensional shape can be any shape desired that can be made during a semiconductor manufacturing process (figs. 3A - 4F, and page 5, ¶s 55 and 62).

In regards to claim 12, Shchegrov discloses a method for optically inspecting a sample (fig. 5A), comprising illuminating the sample with a probe beam (page 4, ¶ 48), measuring the diffraction resulting from the interaction of the probe beam and the sample (page 4, ¶ 49), defining a model of the sample, the model including at least one line having a width defined to vary of the length of the line (page 5, ¶s 55, 58-59, and 62), evaluating the model in three dimensions to predict the diffraction resulting from the interaction of the probe beam and the sample (page 6, ¶ 63), and adjusting and reevaluating the model to minimize the difference between the predicted and measured data (page 6, ¶ 67).

In regards to claim 15, Shchegrov discloses an apparatus for evaluating a wafer having one or more lines formed on the surface thereof (figs. 1A, and 2) comprising a light source for generating a probe beam (22), a detector for detecting light from the probe beam diffracted from the wafer and generating measurement signals (34, 60, 84) and a processor (40). In regards to the processor "for comparing the measurement signals..." it has been held that a recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus satisfying the claimed structural limitations. *Ex Parte Masham*, 2 USPQ F.2d 1647 (1987). Shchegrov's apparatus meets all the structural limitations of this claim, and therefore would be capable of performing the process as disclosed.

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In regards to claim 16, the signals are compared to a database of theoretical data generated using a parametrized model (page 5, ¶s 55, 58-59, and 62).

In regards to claim 17, the processor iteratively adjusts the model so that the differences between the theoretical data and the measurement signals are minimized (page 6, ¶ 67).

In regards to claim 18, the light source is a broadband light source (22), and the detection means generates measurement signals as a function of wavelength (34, 60, and 84).

In regards to claim 19, the apparatus includes a spectrometer (34, 60, 84).

In regards to claim 20, the apparatus can include an ellipsometer (pages 3-4, 46 and 51).

In regards to claims 21-24, the three dimensional shape can be any shape desired that can be made during a semiconductor manufacturing process (figs. 3A - 4F, and page 5, ¶s 55 and 62).

In regards to claim 25, Shchegrov discloses an apparatus for evaluating a wafer having one or more lines formed on the surface thereof (figs. 1A, and 2) comprising a light source for generating a probe beam (22), a detector for detecting light from the probe beam diffracted from the wafer and generating measurement signals (34, 60, 84) and a processor (40). In regards to the processor "for comparing the measurement signals..." it has been held that a recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus satisfying the claimed structural limitations. *Ex Parte Masham*, 2 USPQ F.2d 1647 (1987). Shchegrov's apparatus meets all the structural limitations of this claim, and therefore would be capable of performing the process as disclosed.

*Allowable Subject Matter*

Claims 8-11 are allowed over the prior art of record.

Claims 6-7 and 13-14 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

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The following is a statement of reasons for the indication of allowable subject matter:

As to claim 6, the prior art of record, taken alone or in combination, fails to disclose or render obvious a method for optically inspecting a sample in which a model includes a second series of three-dimensional shapes that refines the definition of the line edge within the sample, in combination with the rest of the limitations of claim 6.

As to claim 8, the prior art of record, taken alone or in combination, fails to disclose or render obvious a method of evaluating the roughness of a line edge on a wafer comprising comparing measured data to calculated data, the calculated data based on a model that includes the scattering effects from an array of holes or mesas and wherein the spacing between the holes or mesas in the models is selected so that the holes or mesas **overlap to approximate an undulating edge** (as seen in figs. 5-6), in combination with the rest of the limitations of claim 8.

As to claim 13, the prior art of record, taken alone or in combination, fails to disclose or render obvious a method for optically inspecting a sample in which a line width is defined in terms of one or more periodic functions, in combination with the rest of the limitations of claim 13.

#### *Additional Prior Art*

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. The prior art made of record is Chang et al. (USPN 6,867,866), Johnson et al. (US Pubs 2002/0038196), Johnson (US Pubs 2005/0280810), Bischoff et al. ("Characterization of 3D resist patterns by means of optical scatterometry"), and Yeung et al. ("Electromagnetic Scatterometry Applied to In Situ Metrology").

Chang et al. discloses a method for optically inspecting a sample comprising illuminating a sample with a probe beam, measuring the diffraction resulting from the interaction of the probe beam and the sample, comparing the diffraction to a library containing models of the sample, including a first series

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of three-dimensional shapes that define the edge of a line within a sample, and determining the model that best fits the diffraction measured.

Johnson et al. discloses a method for optically inspecting a sample, comprising illuminating the sample with a probe beam, measuring the diffraction resulting from the interaction of the probe beam and the sample, defining a model of the sample, evaluating the model to predict the diffraction resulting from the interaction of the probe beam and the sample, and adjusting and reevaluating the model to minimize the difference between the predicted and measured data.

Johnson discloses a method for optically inspecting a sample, comprising illuminating the sample with a probe beam, measuring the diffraction resulting from the interaction of the probe beam and the sample, defining a model of the sample, the model including a first series of three-dimensional shapes that define the edge of a line within the sample, evaluating the model in three dimensions to predict the diffraction resulting from the interaction of the probe beam and the sample, and adjusting and reevaluating the model to minimize the difference between the predicted and measured data.

Bischoff discloses a means of modeling three-dimensional resist patterns that could be used for optically inspecting a three-dimensional shape.

Yeung discloses a means of modeling three-dimensional resist patterns that could be used for optically inspecting a three-dimensional shape.

### *Conclusion*

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kara E Geisel whose telephone number is **571 272 2416**. The examiner can normally be reached on Monday through Friday, 8am to 4pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Gregory J. Toatley, Jr. can be reached on **571 272 2800 ext. 77**. The fax phone number for the organization where this application or proceeding is assigned is **571 273 8300**.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Gregory J. Toatley, Jr.  
SPE  
Art Unit 2877

K.G.  
KEG  
June 22, 2006